

Generic RS-232 Communication Protocol

365-8005
Revision A

For the Use With:

GPStarplus

AccuSync

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DATE	AMENDMENTS
June 20, 2000	Rev 1.93: Changed TOD message from !$TIME,Y,D,H,M,S,M,T,O<cs|cr|lf> to !TIME,Y,D,H,M,S,M,T,O<cs|cr|lf>.
July 7, 2000	Rev 1.94:Added “GPStarplus 565” to description field of ANTD command
Oct 16, 2003	Changed Rev from 1.94 to N/C.
Jan 4, 2005	Rev A: Deleted command related to CommSync product. Added Motorola M12 and Navman receiver details. Changed description of commands: GDOP, GPSE, SIGQ, TRMO, and VERS. Deleted commands RSAH and SSLT.

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The communication protocol consists of command sentences where each command can be queried for a response or the command can be set up for an unsolicited response. Each message sentence is encased between ASCII '$' and '*' character. After the '*' delimiter, there is a 2-byte hexadecimal ASCII checksum followed by a carriage return and a linefeed. The checksum is calculated by X-ORing each successive byte in the message sentence between, but not including, the '$' and '*' characters. The checksum is not needed for sending commands. However, a checksum is always includes in a sentences sent back through the communications port to the user.

Unsolicited Response

Several commands can have an unsolicited flag enabled. By enabling the unsolicited flag, the command will respond accordingly depending on when new information is available. The GPS engine drives most of the unsolicited responses. Use the **UNSL** command to enable or disable unsolicited flag for a particular command. See the **UNSL** command for more information.

Queried Response

Unit Identification Sending the specified message to the user port generates queried responses. Each message has its own response characteristics. Several messages can be queried at one time for multiple responses. If for some reason sent message has not been responded to after five seconds, it can be assumed that the message was not received.

The RS-232 protocol has the ability to send unit identification with each message. This will allow the user to identify where a particular message was originated. However, the command sentence changes slightly. Recall that each message sentence is encased between ASCII '$' and '*' character. The only difference is that after the '$' character, there is an identification number followed by a comma. For more information, see the Set Unit Identification SETI function. This function should be enabled and setup using the front panel. Please refer to the product user manual for details.

Modem Operation

The RS-232 protocol does not support modem operation. Nevertheless, you may connect a modem that has been setup to answer an incoming call. Please note that if unsolicited messages are enabled while the modem is waiting for a call, the modem may disconnect the call during the connection process. Thus, using the unit in a quarry mode is recommended.

Programming Considerations

The communication protocol was designed for both terminal input and computer input. For this reason, an ASCII command set is used. Be aware that there are finite sized send and receive buffers in the unit (about 2048 bytes total). If the buffer should get full, all remaining commands sent to the unit will be truncated. A default baud rate of 19200 or greater is recommended for optimum performance.

The following listing segment illustrates the decoding of the RS-232 command protocol. The target system is Windows 3.11 using Microsoft Visual C++ and the standard Windows communication interface. This is only a listing segment and is only illustrates the technique of building a command. It is not intended as a solution to a communication protocol driver.

```
//////////////////////////////////////////////////////////////////////////
The following definitions define a typical command building sequence:

#define STSEARCHING    1       // Searching for SOM
#define STGETDATA      2       // retrieving data
#define STCHECKSUM1    3       // getting checksum character #1 (MSNibble)
#define STCHECKSUM2    4       // getting checksum character #2 (LSN)

static char State = STSEARCHING;                                        // default - searching
static unsigned char Checksum = 0;                                                 // default
static unsigned char GPSChecksum;                                                          //

static char Command[300];                                                    // command buffer
static int CmdI;                                                              // command index

//////////////////////////////////////////////////////////////////////////
This function resides in the main frame as a 100 ms timer. Hence, the RS-232 communications is in
polling mode.
void CMainFrame::OnTimer(UINT nIDEvent)
{
    char s[550];
    char c;
    int len,i;
    COMSTAT ComStat;

    //////////////////////////////////////////////////////////////////////
    Read characters from a buffer
    if((len = ReadComm(g_Sio.idComDev,s,512)) <= 0)
    {
        GetCommError(g_Sio.idComDev,&ComStat); // Clear the error MS says so.

        if(len == 0) return;   // no characters, then just leave
        len = abs(len);
    }


    //////////////////////////////////////////////////////////////////////
    Go through buffer and build a command
    for (i = 0; i < len; i++)
    {
        c = s[i];  // get character from our temporary buffer
        switch(State)
        {
            ////////////////////////////////////////////////////////////
            case STSEARCHING:
                if(c == '$')
                {
                    State = STGETDATA;
                    Checksum = 0;
                    CmdI = 0;                                       // reset command index to 0
                }
            break;

            ////////////////////////////////////////////////////////////
```

```
            case STGETDATA:
                if(c != '*')
                {
                    Checksum ^= c;
                    Command[CmdI++] = c;                                    // save data into command
                    if(CmdI >= 256) State = STSEARCHING; // No more than 256
                }
                else
                    State = STCHECKSUM1;
            break;

            ////////////////////////////////////////////////////////////////
            case  STCHECKSUM1:
                GPSChecksum = (c - '0');                                    // get msb of checksum
                if(GPSChecksum > 9) GPSChecksum -= ('A' - '9' - 1);
                GPSChecksum = GPSChecksum << 4;
                State = STCHECKSUM2;
            break;

            ////////////////////////////////////////////////////////////////
            case  STCHECKSUM2:

                c = (c - '0');                                              // get lsb of checksum
                if(c > 9) c -= ('A' - '9' - 1);
                GPSChecksum |= c;
                // Check checksum and process messages if CS is OK
                if(Checksum == GPSChecksum)
                {
                    Command[CmdI] = '\0';

                    // This is where you would parse the command string
                    ProcessCommand(Command);                            // process the command string
                }
                else
                {
                    // Checksum error handling here
                }
                State = STSEARCHING;
            break;

        }   // end switch
    }
    CMDIFrameWnd::OnTimer(nIDEvent);                                        // MS VC++ stuff
}
```


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Antenna cable delay value (input/output) ANTD

Setup Command: $ANTD,N*<cr|lf>

Query Command: $ANTD*<cr|lf>

Response: $ANTD,N*<cs|cr|lf>

Description: Retrieves and sets the antenna cable delay compensation value/internal timing offset.

Fields:

Symbol	Range	Description
N	-99999 to 99999	Nanoseconds for GPStarplus 365
	000000 to 999999	Nanoseconds for AccuSync, GPStarplus 465, and GPStarplus 565

Setup Command: $ANTD,234*<cr|lf>

Response: $ANTD,00234< cs|cr|lf>

This example, applicable to the GPStarplus 365, will set the antenna cable delay value to 234 nanoseconds. Propagation delay for most cable is approximately 1.5 nanoseconds per foot. Thus, for a 100-foot cable the antenna cable delay value should be set to 150ns.

Response: $ANTD,000234< cs|cr|lf>

This example, applicable to the AccuSync, and GPStarplus 465 and 565, will set the antenna cable delay value to 234 nanoseconds. Propagation delay for most cable is approximately 1.5 nanoseconds per foot. Thus, for a 100-foot cable the antenna cable delay value should be set to 150ns.

Non-Volatile: Yes

Factory Default: 0 ns

Compatibility: GPStarplus, AccuSync

Azimuth and Elevation (output) AZEL

Query Command: $AZEL*<cr|lf>

Response: $AZEL,N,S,E,A, . . . S,E,A*<cs|cr|lf>

Description: Outputs the satellite PRN followed by the elevation in degrees above the horizon and azimuth in degrees relative to true north. This command message may very in length. Although, the maximum number of satellites will never exceed twelve (12).

Fields:

Symbol	Range	Description
N	00 to 12	Satellites in view
S	00 to 32	Sat PRN number. A 00 will indicate that there is no information available.
E	00 to 90	Elevation
A	000 to 359	Azimuth

Compatibility: GPStarplus, AccuSync

Beep On/Off — BEEP

Setup Command: $BEEP,N*<cr|lf>

Response: $BEEP,N*<cs|cr|lf>

Description: This command enables or disables the 1PPS beep.

Fields:

Symbol	Range	Description
N	1 or 0	1 = On, 0 = Off

Non-Volatile: Yes

Compatibility: GPStarplus, AccuSync

DAC control (input/output) DACV

Setup Command: $DACV,N*<cr|lf>

Query Command: $DACV*<cr|lf>

Response: $DACV,N*<cs|cr|lf>

Description: Sets or reads the DAC value.

Fields:

Symbol	Range	Description
N	0 - 65535	DAC value for oscillator where 32767 is center voltage

Compatibility: GPStarplus, AccuSync

Estimator Frequency Error, last value (output) EFER

Query Command: $EFER*<cr|lf>

Response: $EFER,N*<cs|cr|lf>

Description: Outputs the most recently calculated frequency error estimate.

Fields:

Symbol	Range	Description
N	0 - 1.00E-999	Calculated frequency error

Compatibility: GPStarplus, AccuSync

Error Message (output) ERRX

Query Command: $ERRX*<cr|lf>

Response: $ERRX,N,M*<cs|cr|lf>

Description: Display a new or most recent error.

Fields:

Symbol	Range	Description
N	0000 - FFFF	Error number
M	Alpha-numeric	ASCII error message

Error Number	Message Text
0x0001	Bad user message
0x0002	Could not write DAC value to EEROM
0x0003	GPS receiver input buffer over flow- buffer purged
0x0004	GPS Communication error. Cycling Resetting GPS
0x0005	GPS GOOD error. Resetting GPS

Compatibility: GPStarplus, AccuSync

Estimator Standard Deviation (output) ESSD

Query Command: $ESSD*<cr|lf>

Response: $ESSD,N*<cs|cr|lf>

Description: Outputs the most recently calculated Standard Deviation of the Estimator error (actual - estimated time error).

Fields:

Symbol	Range	Description
N	0 to 1.00E-999	Standard error of estimate

Compatibility: GPStarplus, Accusync

Estimator Sample Number (output) ESSN

Query Command: $ESSN*<cr|lf>

Response: $ESSN,N*<cs|cr|lf>

Response: Outputs the current estimator sample. One sample is taken per second.

Fields:

Symbol	Range	Description
N	0 to 2^{32}	Sample number

Setup Command: $ESSN*<cs|cr|lf>

Response: $ESSN, 0000010935<cs|cr|lf>

This example indicates that the current estimator sample is 10935 seconds.

Compatibility: GPStarplus, AccuSync

Estimator Cycle (output) ESTC

Query Command: $ESTC*<cr|lf>

Response: $ESTC,N*<cs|cr|lf>

Description: Outputs the completed number of estimator cycles. Specifically, an estimator cycle is where all of the statistical computed terms (EFER, ESSN, ESSD) are reset to zero. The period in which a complete estimator cycle is complete is set by the estimator period (ESTP) command.

Fields:

Symbol	Range	Description
N	0 - 9999999	Current estimator cycle

Compatibility: GPStarplus, AccuSync

Estimator Period (input/output) ESTP

Query Command: $ESTP*<cr|lf>

Response: $ESTP,N*<cs|cr|lf>

Description: Retrieves the estimator period. Estimator periods or estimator cycles is a period in seconds where all of the statistical computations are calculated (EFER, ESSN, ESSD).

Fields:

Symbol	Range	Description
N	100 - 9999999	Estimator period in seconds. Default is 86400

Compatibility: GPStarplus, Accusync

Event Trigger (input/output) EVTG

Query Command: $EVTG*<cr|lf>

Setup Command: $EVTG,D,H,M,S,N,$H_1H_1$,$M_1M_1$,$S_1S_1$,T,P,I*<cr|lf>

Response: $EVTG,D,H,M,S,N,$H_1H_1$,$M_1M_1$,$S_1S_1$,T,P,I*<cs|cr|lf>

Description: Retrieves or sets the event trigger start time, pulse repetition rate, pulse width, and output polarity.

Fields:

Symbol	Range	Description
D	1 - 366	Day of event trigger start time
H	0 -23	Hour of event trigger start time
M	0 - 59	Minute of event trigger start time
S	0 - 59	Second of event trigger start time
N	0 - 9999999	Hundreds of nanoseconds event trigger start time
H_1H_1	0 -99	Hour of event period repetition rate
M_1M_1	0 - 59	Minute of event period repetition rate
S_1S_1	0 - 59	Second of event period repetition rate
T	0 - 99	Hundreds of milliseconds of period repetition rate
P	0.000001 - 8.99999	Hundreds of microseconds of pulse width
I	0 or 1	Inverted or normal pulse output, where: 0 = Normal, 1 = Inverted

Compatibility: GPStarplus

Retrieve GDOP (output) GDOP

Query Command: $GDOP*<cr|lf>

Response: $GDOP,N*<cs|cr|lf>

Description: Outputs the GDOP (Geometrical Dilution of Precision). The GDOP is the measure of the geometry of the satellites and relates to the accuracy of the navigation solution. GDOP is a figure of merit that indicates the quality of the user's latitude, longitude, altitude and timing data. At least 4 satellites must be tracked before the GDOP calculations can be made.

Fields:

Symbol	Range	Description
N	000.00 - 999.99	GDOP value

Note: In Known mode, the GDOP value is set to zero.

In Position Averaging (Survey) and Dynamic mode, the value is set to zero when less than 4 satellites are tracked.

Compatibility: GPStarplus, AccuSync

GPS Engine Information (output) GPSE

Query Command: $GPSE*<cr|lf>

Response: $GPSE,M,C,N*<cs|cr|lf>

Description: Outputs information on the particular GPS engine the unit is using..

Fields:

Symbol	Range	Description
M	0 - 3	GPS engine manufacture, where: 0 = Magellan 1 = Motorola 2 = Navman Jupiter-T 3 = Motorola M12
C	1 - 12	Number of channels the GPS engine is capable of.
N	1 - 2	Number of GPS engines installed.

Use Following table to determine the number of satellite channels your unit can track.

Magellan	5 Channel
Motorola UT+	8 Channel
Motorola M12	12 Channel
Navman Jupiter-T	12 Channel

Compatibility: GPStarplus, AccuSync

Time Code Output Format (input/output) IRIG

Query Command: $IRIG*<cr|lf>

Setup Command: $IRIG,N*<cr|lf>

Response: $IRIG,N*<cs|cr|lf>

Description: Reads or selects the IRIG time code output format.

Fields:	**Symbol**	**Range**	**Description**
	N	A, B or G	IRIG output format for IRIG A, B or G

Compatibility: GPStarplus

GPS / UTC Time Difference (output) LEAP

Query Command: $LEAP*<cr|lf>

Response: $LEAP,P,F*<cs|cr|lf>

Description: Reports the present and future difference in seconds between GPS time and UTC.

Fields:

Symbol	Range	Description
P	00 to 99	Present difference in seconds between GPS and UTC time
F	00 to 99	Future difference in seconds between GPS and UTC time

Note: If the Present and Future difference value is the same, then no Leap second event is pending. If the difference value is greater or smaller, then a Leap second event is pending.

Non-Volatile: No

Factory Default: 00 Present Leap Seconds and 00 Future Leap Seconds

Compatibility: GPStarplus, AccuSync

Lock Keypad Edit Key (input/output) LOCK

Query Command: $LOCK*<cr|lf>

Setup Command: $LOCK,N*<cr|lf>

Response: $LOCK,N*<cs|cr|lf>

Description: Retrieves the status or sets Disable/Enable status of the keypad edit key.

Fields:

Symbol	Range	Description
N	0 or 1	0 = Unlock, 1 = Lock

Compatibility: GPStarplus

Manual Time Mode (input/output) MANM

Setup Command: $MANM,E,Y,M,D,H,$M_1$,S*<cr|lf>

Response: $MANM,E,Y,M,D,H,$M_1$,S*<cs|cr|lf>

Query Command: $MANM*<cr|lf>

Response: $MANM,E*<cs|cr|lf>

Description: Retrieves the manual time mode setting or enables/disables the manual time mode. When enabled, this command allows setting of the time.

Fields:

Symbol	Range	Description
E	0 or 1	Enables or disables manual mode, where: 0 = Disable, 1 = Enable
Y	0 - 9999	Year
M	1 - 12	Month
D	1 - 31	Day
H	0 - 23	Hour
M_1	0 - 59	Minutes
S	0 - 59	Seconds

Note: If the manual mode is set to disabled “0”, then all parameters after the first parameter, “E” are ignored.

Non-Volatile: No

Compatibility: GPStarplus, AccuSync

Message (output - unsolicited) MESG

Query Command: NONE

Response: $MESG,MESSAGE*<cs|cr|lf>

Description: The message is unsolicited. If the unit should develop an error or notify the user of various statuses, a message command will be generated.

Fields:

Symbol	Range	Description
MESSAGE	N/A	alphanumericMessage string

Compatibility: GPStarplus, AccuSync

Not Time Locked Count (output) NTLC

Query Command: $NTLC*cr|lf>

Response: $NTLC,N*<cs|cr|lf>

Description: The command will return the number of seconds the unit has been out of time-lock. The count only increments after the unit has been time-locked at least once.

Fields:

Symbol	Range	Description
N	2^{32}	Number of seconds out of time-lock

Compatibility: GPStarplus, AccuSync

Option Board (output) OPBD

Query Command: $OPBD*cr|lf>

Response: $OPBD,N*<cs|cr|lf>

Description: Returns the type of option board installed.

Fields:

Symbol	Range	Description
N	1 - 254	Option board type. See table below for description

Option board ID	Description
1	High Frequency Synthesizer board
2	Low Frequency Synthesizer board

Note: If no option board is installed, the response is 255

Compatibility: GPStarplus

Position Average Status (output) PAVG

Query Command: $PAVG*<cr|lf>

Response: $PAVG,D,M,H,$D_1$,$M_1$,$H_1$,A,S*<cs|cr|lf>

Description: Retrieves the last value of the averaged latitude, longitude and altitude of the connected antenna. (Same as SPOS data).

Fields:

Symbol	Range	Description
D	0 - 89	Latitude degrees
M	0.0 - 59.9999	Latitude minutes
H	N or S	Hemisphere
D_1	0 - 179	Longitude degrees
M_1	0.0 - 59.9999	Longitude minutes
H_1	E or W	Hemisphere
A	-300.0 to 99999.9	Altitude in meters
S	0 2^{32}	Number of samples taken

Compatibility: GPStarplus, AccuSync

Product ID (output) PRID

Setup Command: $PRID*<cr|lf>

Response: $PRID,N,S*<cs|cr|lf>

Description: Outputs the product ID and short string description.

Fields:	**Symbol**	**Range**	**Description**
	N	000 - 999	Product ID, where: 000 = GPStarplus 001 = KStar 002 = KStar II 003 = GPSync (Obsolete) 004 = PCS-GPS 005 = LStar 006 = CommSync 10 MHz 007 = CommSync 5 MHz 008 = RPCS GPS 009 = Teletrac AccuSync 010 = GPStat II 011 = AccuSync I 012 = Compact GPS 013 = SWI Module 014 = SWI System 015 = NanoSync/TCXO 016 = NanoSync/SOCXO 017 = NanoSync/DOCXO 018 = NanoSync/Rubidium 019 – 29 = Reserved 030 = CommSync II 031 – 999 = Reserved
	S	ASCII	Product name. See N symbol

Compatibility: As indicated

Rate Output (input/output) ROUT

Setup Command: $ROUT,C,M,R,I,D*<cr|lf>

Setup Command: $ROUT*<cr|lf>

Response: $ROUT,B,M,R,I,D*<cs|cr|lf>

Description: Sets the specified pulse rate output port to a desired rate, or reads the setting.

Fields:

Symbol	Range	Description
C	A or B	Output port to set
M	1 - 19	See mode table
R	2 - 1000000	Rate in microseconds
I	0 or 1	Invert flag, where: 0 = No inverted output 1 = Inverted output
D	1 or 0	Divide by 2, where: 0 = No division 1 = Divide by 2

Mode Table

Mode Number	Description
0	Set selected channel to programmed rate between 2us and 1000000us. Select 1us pulse, or square wave output. Select normal or inverted wave form.
1	Set selected channel to 10MPPS pulse, 200 ns wide
2	Set selected channel to 5MPPS pulse, 100 ns wide
3	Set selected channel to 1MPPS pulse, 50 ns wide
4	Set selected channel to 100K PPS pulse, 1us wide
5	Set selected channel to 100K PPS square wave
6	Set selected channel to 10K PPS pulse, 1us wide
7	Set selected channel to 10K PPS square wave
8	Set selected channel to 1K PPS pulse, 1us wide
9	Set selected channel to 1K PPS square wave
10	Set selected channel to 100 PPS pulse, 1us wide
11	Set selected channel to 100 PPS square wave
12	Set selected channel to 50 PPS pulse, 1us wide
13	Set selected channel to 50 PPS square wave
14	Set selected channel to 20 PPS pulse, 1us wide
15	Set selected channel to 20 PPS square wave
16	Set selected channel to 10 PPS pulse, 1us wide
17	Set selected channel to 10 PPS square wave
18	Set Selected channel to 1PPS pulse, 2ms wide
19	Set Selected channel to 1PPM pulse, 1sec wide

Compatibility: GPStarplus

Reset GPS receiver (input) RSTG

Setup Command: $RSTG,N*<cr|lf>

Response: $RSTG,N*<cs|cr|lf>

Description: Resets GPS receiver to a cold start (re-initializes the GPS receiver)

Fields:

Symbol	Range	Description
N	C	C Represents a cold start

Setup Command: $RSTG,C*<cr|lf>

Response: $RSTG,C*<cr|lf>

Description: Re-initializes the GPS receiver, while maintaining current almanac and ephemeris.

Issuing a cold start re-initializes the receiver. The receiver will start to "search the sky" to acquire active GPS satellites. This process could require several minutes to complete.

Compatibility: GPStarplus, AccuSync

Set Output Frequency (input/output) SETF

Setup Command: $SETF,A,B,C*<cr|lf>

Setup Command: $SETF*<cr|lf>

Response: $SETF,A,B,C*<cs|cr|lf>

Description: Retrieves the selection or selects the frequency of the frequency output ports, or reads the selection.

Fields:

Symbol	Range	Description
A	0, 1, 5, 10	Port 1 frequency setup, where: 0 = Off 1 = 1 MHz 5 = 5 MHz 10 = 10 MHz
B	0, 1, 5, 10	Port 2 frequency setup, where: 0 = Off 1 = 1 MHz 5 = 5 MHz 10 = 10 MHz
C	0, 1, 5, 10	Port 3 frequency setup, where: 0 = Off 1 = 1 MHz 5 = 5 MHz 10 = 10 MHz

Compatibility: GPStarplus

Satellite Signal quality (output) SIGQ

Setup Command: $SIGQ*<cr|lf>

Setup Command: $SIGQ,S,N,C,S,N,C,S,N,C,S,N,C,S,N,C,S,N,C,S,N,C*<cs|cr|lf>

Response: Outputs satellite PRN, signal strength and tracking mode.

Fields:

Symbol	Range	Description
S	00 - 32	Satellite PRN number
N	0 - 9	Signal strength, where: 0 is no signal and 9 represents full signal, and: 8, 9 = Very good 6, 7 = Good 4, 5 = Weak $\leq$ 3 = Not usable The signal strength value 'N' is calculated from the GPS receiver's Signal to Noise Ratio value (SNR) as follows: (SNR-25)/2.5, where SNR is expressed as dB/Hz.
C	0 - 2	Tracking mode, where: 0 = Searching 1 = Acquiring 2 = Using for navigation/timing

Although some receivers track more than 8 satellites, the SIGQ command returns PRN tracking information for up to 8 satellites. Use the following table to determine the number of satellite channels your unit can track. The GPSE command will inform you to what GPS engine you are using.

Magellan	5 Channel
Motorola UT+	8 Channel
Navman Jupiter-T	12 Channel
Motorola M12	12 Channel

Compatibility: GPStarplus, AccuSync

Set Synthesizer frequency (input/output) SNTH

Setup Command: $SNTH,N*<cr|lf>

Query Command: $SNTH*<cr|lf>

Response: $SNTH,N*<cs|cr|lf>

Description: Retrieves or sets the synthesizer frequency. This option is only available if the low frequency or high frequency board is installed.

Fields:

Symbol	Range	Description
N	1 - 15000000	Frequency in Hz. Please note that this function will not perform any range checking. For the low frequency synthesizer use values between 1 Hz and 150,000 Hz. For the high frequency synthesizer board, use values between 100,000,000 and 15,000,000 Hz, with 5 Hz resolution. If values outside the recommended values are used, unpredictable results may occur.

Compatibility: GPStarplus

Latitude and Longitude and Elevation position (output) SPOS

Query Command: $SPOS*<cr|lf>

Response: $SPOS,D,M,H,$D_1$,$M_1$,$H_1$,A*<cs|cr|lf>

Response: Retrieves the last value of the averaged latitude, longitude and altitude of the connected antenna. (Same as PAVG data).

Fields:

Symbol	Range	Description
D	0 - 89	Latitude degrees
M	0.0 - 59.9999	Latitude minutes
H	N or S	Hemisphere
D_1	0 - 179	Longitude degrees
M_1	0.0 - 59.9999	Longitude minutes
H_1	E or W	Hemisphere
A	-300.00 to 17680.00	Altitude in meters

Compatibility: GPStarplus, AccuSync

Clear Time Tag Buffer TAGC

Setup Command: $TAGC*<cr|lf>

Response: $TAGC*<cs|cr|lf>

Description: Clears the internal time tag buffer and resets the time tag counter to zero. The buffer is capable of holding 100 time tags. If the time tag mode is set to wrap mode (see TAGM), the list is automatically cleared when the maximum number of time tags is reached and the time tag is set to zero.

Compatibility: GPStarplus

Time Tag, Most Recent (output) TAGL

Setup Command: $TAGL*<cr|lf>

Response: $TAGL,T,D,H,M,S,N*<cs|cr|lf>

Description: Displays the most recent time tag.

Fields:

Symbol	Range	Description
T	0 - 100	Time tag number
D	1 - 366	Day of time tag
H	0 -23	Hour of time tag
M	0 - 59	Minute of time tag
S	0 - 59	Second of time tag
N	0 - 9999999	Hundreds of nanoseconds

Compatibility: GPStarplus

Set Time Tag Mode (input/output) TAGM

Setup Command: $TAGM,M*<cr|lf>

Setup Command: $TAGM*<cr|lf>

Response: $TAGM,M*<cs|cr|lf>

Description: Retrieves or sets the time tag mode of operation. Currently, there are two modes of operation: wrap mode and burst mode. In wrap mode, time tags are recorded into a buffer and when the buffer reaches its limit, it resets itself and wraps back to the beginning. In burst mode, time tags are stored in to a buffer and when the buffer fills, no more time tags are stored.

Fields:

Symbol	Range	Description
M	W or B	Set time tag mode, where: W = wrap mode B = burst mode

Compatibility: GPStarplus

Time Tag (output) TAGT

Setup Command: $TAGT*<cr|lf>

Response: $TAGT,T,D,H,M,S,N*<cs|cr|lf>

Description: Displays the time tag buffer. The output may be many lines of time tags depending on the amount of time tags recorded.

Fields:

Symbol	Range	Description
T	0 - 100	Time tag number
D	1 - 366	Day of time tag
H	0 -23	Hour of time tag
M	0 - 59	Minute of time tag
S	0 - 59	Second of time tag
N	0 - 9999999	Hundreds of nanoseconds

Compatibility: GPStarplus

Internal Temperature (output) TEMP

Setup Command: $TEMP*<cr|lf>

Response: $TEMP,N*<cs|cr|lf>

Description: Reports the internal temperature on the unit.

Fields:	**Symbol**	**Range**	**Description**
	N	-25.0 ^{o} C to 85.0 ^{o} C	Temperature range

Compatibility: GPStarplus, AccuSync

Time difference between GPS 1 PPS and oscillator 1 PPS (output) TIMD

Setup Command: $TIMD*<cr|lf>

Response: $TIMD,N*<cs|cr|lf>

Description: Outputs the time difference between GPS receiver's1 PPS output and the unit's 1 PPS output in nanoseconds.

Fields:

Symbol	Range	Description
N	0 to +/-268435456	Time difference in nano-seconds

Note: Time difference value is valid only in Time Lock mode.

Compatibility: GPStarplus, AccuSync

Time (output) TIME

Setup Command: $TIME*<cr|lf>

Response: $TIME,Y,D,H,M,S,m,T,O*<cs|cr|lf>

Description: Retrieves the current time that the unit has calculated.

Fields:

Symbol	Range	Description
Y	to 9999	Year
D	1 - 366	Day of Year
H	0 - 23	Hour
M	0 - 59	Minute
S	0 - 59	Seconds
m	1 - 5	Time Mode, where: 1 = GPS Time 2 = UTC Time 3 = LUTC (Local UTC) Time 4 = LGPS (Local GPS) Time 5 = MAN (Manual Time)
T	4 - 9	TFOM (See Time Figure of Merit table)
O	0 - 4	Operation Mode, where: 0 = Warm-up 1 = Time Locked 2 = Coasting 3 = Recovering 4 = Manual (Manual Time)

Compatibility: GPStarplus, AccuSync

Figure 1A: Time Figure of Merit (TFOM)
for GPStarplus, AccuSync, CommSync

TFOM Value	Expected Time Error (ETE)
4	100 ns ETE $\leq$1 μs
5	1 μs < ETE $\leq$10 μs
6	10 μs < ETE $\leq$ 100 μs
7	100 μs < ETE $\leq$ 1 ms
8	1 ms < ETE $\leq$ 10 ms
9	10 ms < ETE

Time Mode (input/output) TIMM

Setup Command: $TIMM,M,L*<cr|lf>

Setup Command: $TIMM*<cr|lf>

Response: $TIMM,M,L*<cs|cr|lf>

Description: Sets the time mode and local time offset

Fields:	**Symbol**	**Range**	**Description**
	M	1 - 5	Time Mode, where: 1 = GPS Time 2 = UTC Time 3 = LUTC (Local UTC Time) 4 = LGPS (Local GPS Time) 5 = MAN (Manual Time)
	L	-12 to 12	Local Hours Offset from UTC

Compatibility: GPStarplus

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Setup Command: $TIMM,M,h,m*<cr|lf>

Setup Command: $TIMM*<cr|lf>

Response: $TIMM,M,h,m*<cs|cr|lf>

Description: Sets the time mode and local time offset

Fields:	**Symbol**	**Range**	**Description**
	M	1 - 4	Time Mode, where: 1 = GPS Time 2 = UTC Time 3 = LUTC (Local UTC Time) 4 = LGPS (Local GPS Time) 5 = MAN (Manual Time)
	h	- 14 to +14	Hours Local Offset behind or ahead of UTC
	m	0 or 30	Minutes Local Time Offset from UTC

Compatibility: AccuSync

Time Of Day (output port) TOD

Setup Command: NONE (Message is generated continuously)

Query Command: NONE (Message is generated continuously)

Response: !TIME,Y,D,H,M,S,m,T,O

Description: The TOD message is modeled after the TIME message. All fields within the TOD message are the same as the TIME message except for the on time character, '!'. The rising edge of the first bit of the on time character occurs within 1 ms after the rising edge of the 1 PPS reference signal.

NOTE: The RS-232 settings for this port are fixed at 9600 baud, 8 data bits, one stop bit and no parity.

Please see the TIME message for a description on each field.

Compatibility: GPStarplus

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Setup Command: NONE (Message is generated continuously)

Query Command: NONE (Message is generated continuously)

Response: !TIME,Y,D,H,M,S,m,T,O<cr|lf>

Description: The TOD message is modeled after the TIME message. All fields within the TOD message are the same as the TIME message except for the on time character, '!'. The rising edge of the first bit of the on time character occurs within 1 ms after the rising edge of the 1 PPS reference signal.

Note: The RS-232 settings for this port are fixed at 9600 baud, 8 data bits, one stop bit and no parity. The message string is terminated with a carriage return followed by a linefeed.

Please see the TIME message for a description on each field.

Compatibility: AccuSync

Time Of Day String(input/output) TODS

Setup Command: $TODS,M*<cr|lf>

Query Command: $TODS*<cr|lf>

Response: $TODS,M*<cs|cr|lf>

Description: Reads or sets the rate of the Time Of Day (TOD) output message to either every second or every even second.

Fields:

Symbol	Range	Description
M	1 or 2	Message output rate, where: 1 = Every second 2 = Every even second

Compatibility: AccuSync

Time Recovery Mode (input/output) TRMO

Setup Command: $TRMO,X*<cr|lt>

Query Command: $TRMO*<cr|lf>

Response: $TRMO,X*<cs|cr|lf>

Description: Retrieves or sets the Time Recovery Mode of operation.

Note: The user can only select the Dynamic and Position Average (Survey) mode. The known mode is automatically determined by the receiver.

Fields:

Symbol	Range	Description
X	D	Dynamic
	K	Known (Read Only)
	P	Position Averaging (Survey)

Dynamic mode is for use in a moving platform or to determine the user's location.

Known mode is reported by the receiver after it has established its location through its internal auto-survey mechanism.

Position averaging (Survey) mode is the mode the receiver is in while running its auto-survey process. The receiver uses 3-D Lat, Lon, and Alt values when the receiver has acquired a minimum of four satellites with good satellite geometry to compute an averaged position. At the end of the survey process, the unit automatically enters the Known mode using those computed values.

Selecting the Position averaging (Survey) mode from the Known mode typically results in the unit quickly switching back to the Known mode. This is due to the receiver already having valid position data.

Compatibility: GPStarplus, AccuSync

Unsolicited flag (input) UNSL

Setup Command: $UNSL,S*<cr|lf>

Response: $UNSL,S,C*<cs|cr|lf>

Description: Sets or clears the unsolicited flag for a particular command.

Fields:

Symbol	Range	Description
S	Alphanumeric	Four character command
C	1 or 0	1 = Enable unsolicited flag 0 = Disable unsolicited flag

Compatibility: To disable all messages from output use the following statement:
$UNSL,XXXX,1*<cr|lf>

The following table lists essential commands that have unsolicited flags:

Table: Unsolicited Commands

Interval in Seconds					
1	**5**	**10**	**30**	**86400**	**Any Time***
DACV	AZEL	ANTD	LEAP	ESTC	BEEP
EFER	GDOP	TRMO	NTLC		ERRX
ESSD	TEMP				EVTG
ESSN					GPSE
SIGQ					MESG
SPOS					ROUT
TIMD					TAGL
TIME					

*Anytime refers to a user interaction from the keypad on box level products. If board level product is used, then these commands must be queried. This does not apply to the ERRX and MESG command.

Get Current Firmware Version (output) VERS

Setup Command: $VERS*<cr|lf>

Response: $VERS,V,D,G,P*<cs|cr|lf>

Description: Reports the installed application code version and date, receiver firmware version, and application code number

Fields:

Symbol	Range	Description
V	Vx.xx.xx	Application code version
D	Month Day Year	Application code date
G	Varies	GPS engine version.
P	Alphanumeric	Application code part number

Compatibility: GPStarplus, AccuSync